Hypothesis Testing for a Population Mean Checkpoint

Question (1)

According to Facebook's self-reported statistics the average Facebook user has 130 Facebook friends. For a statistics project a student at Contra Costa College tests the hypothesis that CCC students will average more than 130 Facebook friends. She randomly selects 3 classes from the schedule of classes and distributes a survey in these classes. Her sample contains 45 students.

Here are the null and alternative hypotheses for her study: H_0: $\mu = 130$, H_a: $\mu > 130$. What does μ represent in these hypotheses?

A: mean number of Facebook friends for the average user
B: mean number of Facebook friends for the CCC students in her sample
C: mean number of Facebook friends for CCC students

Feedback

A : 0

✗ Not quite right: You are right that Facebook claims that the mean number of Facebook friends is 130 for the average user. But in this study the population of interest is CCC students. The correct answer is C.

B : 0

✗ Incorrect: We never make a hypothesis about a sample. We donâ€™t need to because we can always calculate the mean of a sample. The correct answer is C.

C : 10

✔ Good job! The population of interest is CCC students, so μ is the mean number of Facebook friends for this population.

Question (2)

From her survey data, the statistics student calculates that the mean number of Facebook friends for her sample is 138.7 with a standard deviation of 79.3. She analyzed her data using a t-test and obtained a p-value of .23. What conclusion can she draw from her data?

A: Nothing. The conditions for use of a t-test were not met. She cannot trust that the P-value is accurate for this reason.

B: Even though 138.7 is larger than 130, it is not significantly larger than 130. In other words, the data do not provide enough evidence to conclude that the mean number of Facebook friends of all CCC college students is higher than 130.

C: 138.7 is significantly larger than 130. In other words the data provide provide enough evidence to conclude that the mean number of Facebook friends of all CCC college students is higher than 130.

Feedback

A : 0

✘ Incorrect: The conditions for use of a T-test are met because the sample size is greater than 30. The correct answer is B.

B : 10

✔ Good job! Since the p-value is 0.23, the difference of 8.7 friends (138.7â€“130) is not statistically significant.

C : 0

✘ Incorrect: Since the p-value is 0.23, the difference of 8.7 friends (138.7â€“130) is not statistically significant. The correct answer is B.

Question (3)

According to Facebook's self-reported statistics, the average Facebook user is connected to 80 community pages, groups and events. For a statistics project a student at Contra Costa College tests the hypothesis that CCC students will average less than 80 such connections. She posts a survey on her Facebook page. Her sample contains 45 responses.

She chooses a 5% level of significance. From her data she calculates a t-test statistic of approximately -1.74 with a P-value of about 0.04. What can she conclude?

A: Nothing. The conditions for use of a T-model are not met. She cannot trust that the P-value is accurate for this reason.

B: The data is not statistically significant. In other words, the data do not provide enough evidence to conclude that the mean number of Facebook connections to community pages, groups and events of all CCC college students is less the 80.

C: The data is statistically significant. In other words, the data do provide enough evidence to conclude that the mean number of Facebook connections to community pages, groups and events of all all CCC college students is less the 80.

Feedback

A : 10

✓ Good job! We do not know if the 45 responses are from CCC students. Also, this is not a ***random*** sample of CCC students.

B : 0

✗ Incorrect: She did not take a ***random*** sample of CCC students. The correct answer is A.

C : 0

✗ Not quite right: She did not take a ***random*** sample of CCC students, so she should not conduct the test. However, if the sample was random, you have the right conclusion based on the P-value. The correct answer is A.

Question (4)

The Food and Drug Administration (FDA) is a U.S. government agency that regulates (you guessed it) food and drugs for consumer safety. One thing the FDA regulates is the allowable insect parts in various foods. You may be surprised to know that much of the processed food we eat contains insect parts. An example is flour. When wheat is ground into flour, insects that were in the wheat are ground up as well. The mean number of insect parts allowed in 100 grams (about 3 ounces) of wheat flour is 75. If the FDA finds more than this number, they conduct further tests to determine if the flour is too contaminated by insect parts to be fit for human consumption.

The FDA takes a random sample of 35 bags of flour for evaluation and finds that they contain an average of 80 insect parts per 100 grams, with a standard deviation of 6.3.

What hypothesis test should be used to determine whether the sample contains more than the allowed 75 insect parts per 100 grams?

A: z-test for the population mean
B: t-test for the population mean
C: z-test for the population proportion
D: t-test for the population proportion

Feedback

A : 0

✗ That is incorrect. While a population mean is being assessed, since the population standard deviation is unknown, the appropriate hypothesis test would be the t-test for the population mean. Thus the correct answer is B.

B : 10

✓ Correct! Since the population mean is being assessed and the population standard deviation is unknown, the appropriate

hypothesis test would be the t-test for the population mean.

C : 0

That is incorrect. A population mean (population average of 75 insect parts per 100 grams), rather than population proportion is being assessed. In addition, the population standard deviation is unknown. Thus, the appropriate hypothesis test would be the t-test for the population mean. Therefore, the correct answer is B.

D : 0

That is incorrect. While the population standard deviation is unknown, a population mean (population average of 75 insect parts per 100 grams), rather than population proportion is being assessed. Thus, the appropriate hypothesis test would be the t-test for the population mean. Therefore, the correct answer is B.

Use the following content for questions 5,6,7 and 8.

The Wechsler Adult Intelligence Scale (IQ test) is constructed so that Full Scale IQ scores follow a normal distribution, with a mean of 100, and a standard deviation of 15. The mayor of Smart Town believes the county's residents are smarter than the national average and wants to use it (the intelligence of the residents) as a marketing tool to bring industries to the area. A researcher is hired to conduct a study to determine whether Smart County's residents have, on average, higher Full Scale IQs than the population. A random sample of 100 people from Smart County were given the IQ test and were found to have an average Full Scale IQ of 105.

Question (5)

What hypothesis test should be used to determine whether the mean Full Scale IQ score of the Smart County residents is higher than the national average?

A: z-test for the population mean

B: t-test for the population mean

C: z-test for the population proportion

D: t-test for the population proportion

Feedback

A : 10

✔ Correct! Since the population mean is being assessed and the population standard deviation is known, the appropriate hypothesis test would be the z-test for the population mean.

B : 0

✘ That is incorrect. While a population mean is being assessed, since the population standard deviation is known, the appropriate hypothesis test would be the z-test for the population mean. Thus the correct answer is A.

C : 0

✘ That is incorrect. While the population standard deviation is known, a population mean (population average Full Scale IQ score is 100), rather than population proportion is being assessed. Thus, the appropriate hypothesis test would be the z-test for the population mean. Therefore, the correct answer is A.

D : 0

✘ That is incorrect. A population mean (population average Full Scale IQ score is 100), rather than population proportion is being assessed. In addition, the population standard deviation is known. Thus, the appropriate hypothesis test would be the z-test for the population mean. Therefore, the correct answer is A.

Question (6)

What are the null and alternative hypotheses?

A: $H_0 : \mu = 105$; $H_a : \mu \neq 105$

B: $H_0 : \mu = 105$; $H_a : \mu > 105$

C: $H_0 : \mu = 100; H_a : \mu \neq 100$

D: $H_0 : \mu = 100; H_a : \mu > 100$

Feedback

A : 0

✗ That's not quite right. 105 is the sample mean Full Scale IQ score and not the null value. Also, note that the researcher wants to test whether the mean Full Scale IQ score of the Smart County residents is ***higher*** than the population mean. The correct answer is D.

B : 0

✗ This is not quite right. While the sign of the alternative hypothesis is correct, note that 105 is the sample mean, and not the null value. The correct answer is D.

C : 0

✗ This is not quite right. While it is true that the null value is 100, note that the researcher wants to test whether the mean Full Scale IQ score of the Smart County residents is ***higher*** than the population mean. The correct answer is D.

D : 10

✓ Correct! The researcher wants to test whether the mean Full Scale IQ score of the Smart County residents is ***higher*** than the population mean.

Question (7)

What is the value of the test statistic used to determine whether the mean Full Scale IQ score of the Smart County residents is higher than the national average?

A: .333

B: -.333

C: 3.33

D: -3.33

Feedback

A : 0

✗ That's not quite right. While the population mean was correctly subtracted from the sample mean (105 - 100), it looks like the population standard deviation was used in the denominator, rather than the standard deviation of the sample means. The correct test statistic is: (105 - 100) / (15/squareroot 100) or (105-100)/(15/10) = 5/1.5 or 3.33. Thus, C is the correct answer.

B : 0

✗ That's not quite right. It looks like the sample mean was subtracted from the population mean. In addition, it looks like the population standard deviation was used in the denominator, rather than the standard deviation of the sample means. The correct test statistic is: (105 - 100) / (15/squareroot 100) or (105-100)/(15/10) = 5/1.5 or 3.33. Thus, C is the correct answer.

C : 10

✓ Correct! The correct test statistic is: (105 - 100) / (15/squareroot 100) or (105-100)/(15/10) = 5/1.5 or 3.33.

D : 0

✗ That's not quite right. It looks like the sample mean was subtracted from the population mean. The correct test statistic is: (105 - 100) / (15/squareroot 100) or (105-100)/(15/10) = 5/1.5 or 3.33. Thus, C is the correct answer.

Question (8)

After analyzing the data to determine whether the mean Full Scale IQ score of the Smart County residents is higher than the national average, the P-value of .0004 was obtained. Using a .05 significance level, what conclusion can be drawn from the data?

A: Do not reject the null hypothesis. The average Full Scale IQ of Smart County residents is not higher than the population

average.

B: Do not reject the null hypothesis. The average Full Scale IQ of Smart County residents is higher than the population average.

C: Reject the null hypothesis. The average Full Scale IQ of Smart County residents is not higher than the population average.

D: Reject the null hypothesis. The average Full Scale IQ of Smart County residents is higher than the population average.

Feedback

A : 0

✗ That's not quite right. Since the P-Value of .0004 is less than .05, we would reject the null hypothesis and conclude that the mean Full Scale IQ score of residents of Smart County (105) is higher than the population average.Therefore, the correct answer is D.

B : 0

✗ That's not quite right. Since the P-Value of .0004 is less than .05, we would reject the null hypothesis and conclude that the mean Full Scale IQ score of residents of Smart County (105) is higher than the population average.Therefore, the correct answer is D.

C : 0

✗ That's not quite right. While we would reject the null hypothesis, because the P-Value of .0004 is less than .05, we would conclude that the mean Full Scale IQ score of residents of Smart County (105) is higher than the population average. Therefore, the correct answer is D.

D : 10

✓ Good job! Since the P-Value of .0004 is less than .05, we would reject the null hypothesis and conclude that the mean Full Scale IQ score of residents of Smart County (105) is higher than the population average.